

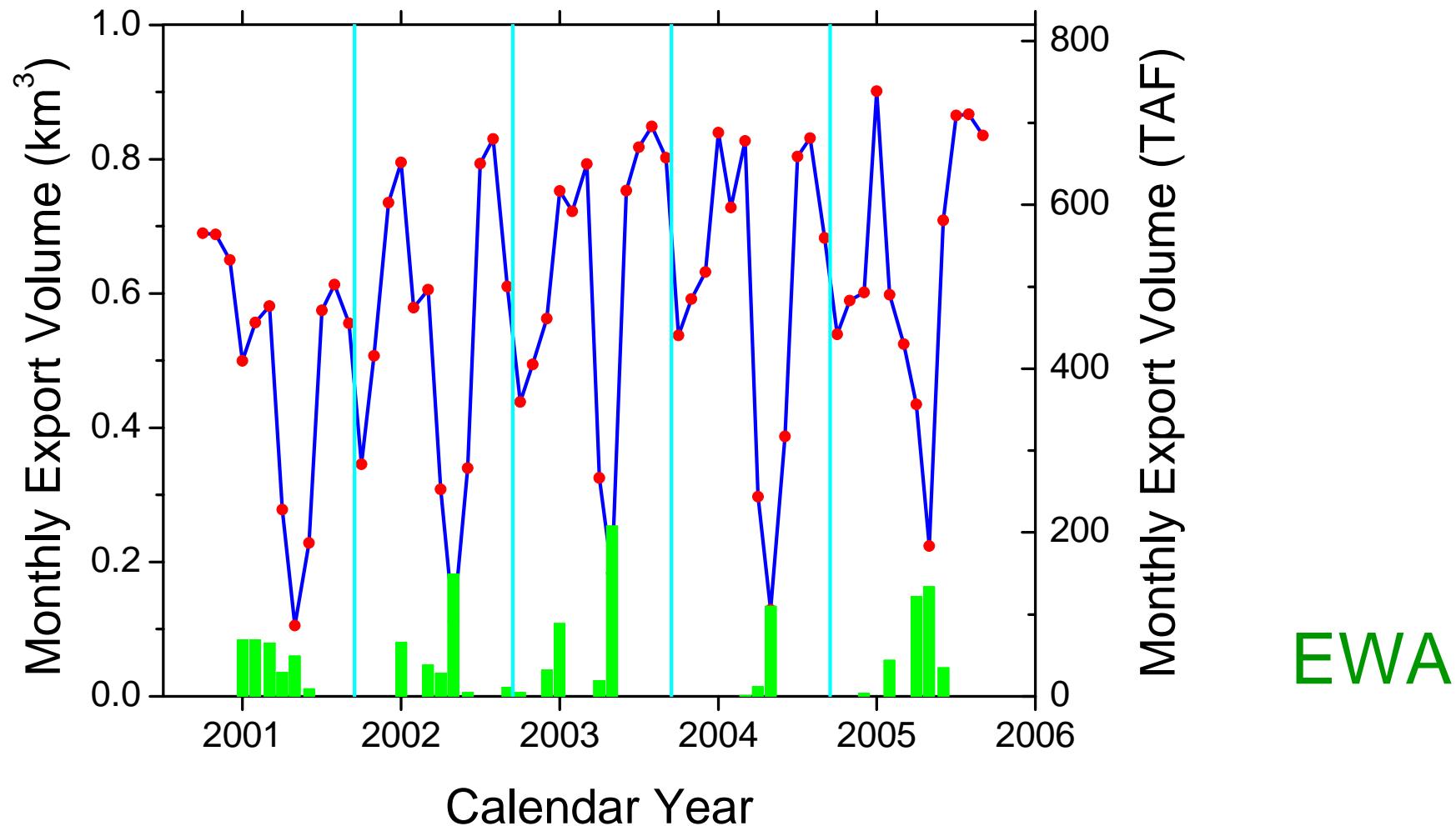
Likely effects of EWA on fish populations

Wim Kimmerer
Romberg Tiburon Center
San Francisco State University

Summary

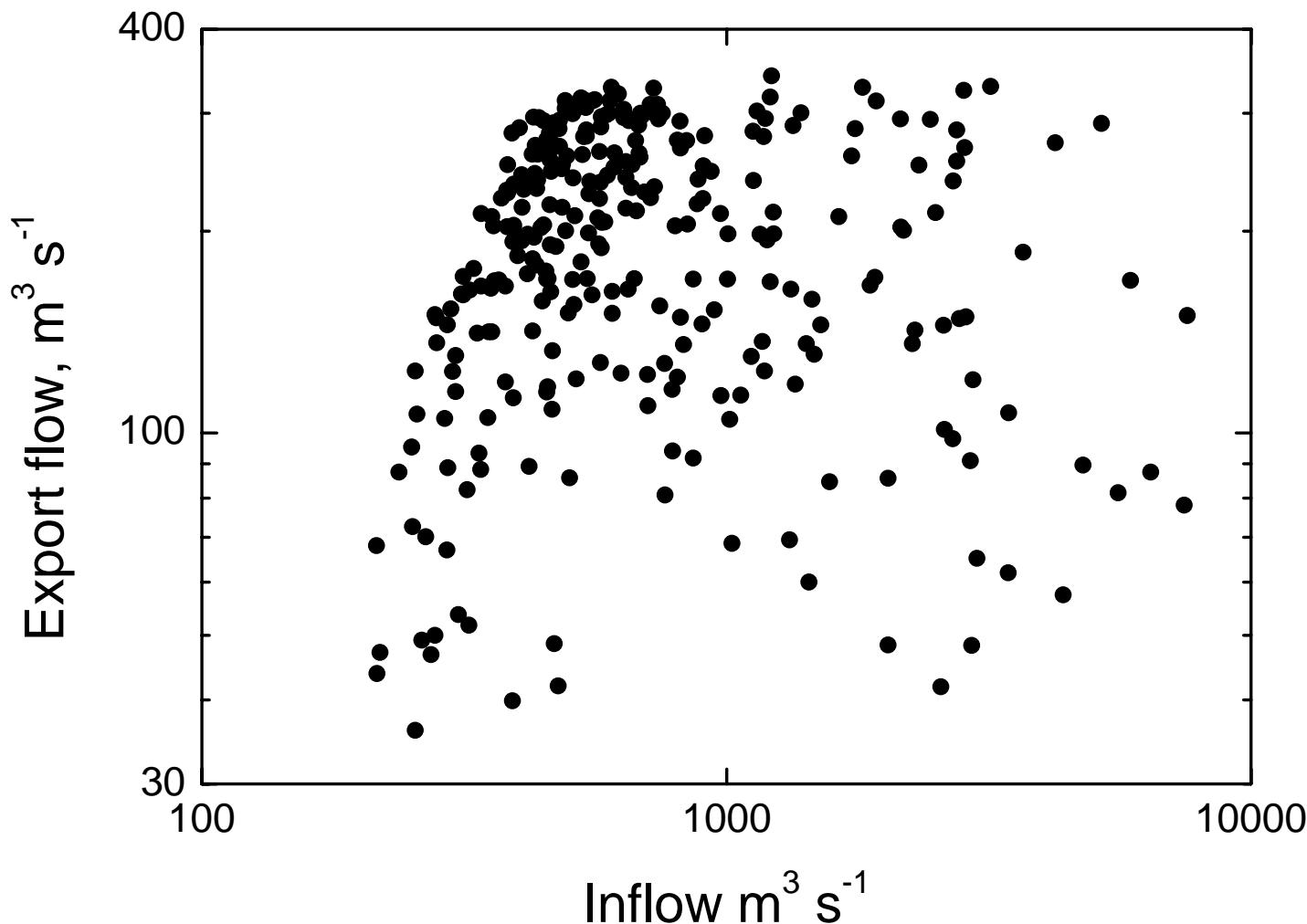
- Export effects on Fish
 - Winter-run Chinook salmon
 - Adult delta smelt
 - Juvenile delta smelt
- Contributions of EWA
 - Historic patterns
 - Projected patterns

Export Flow and EWA



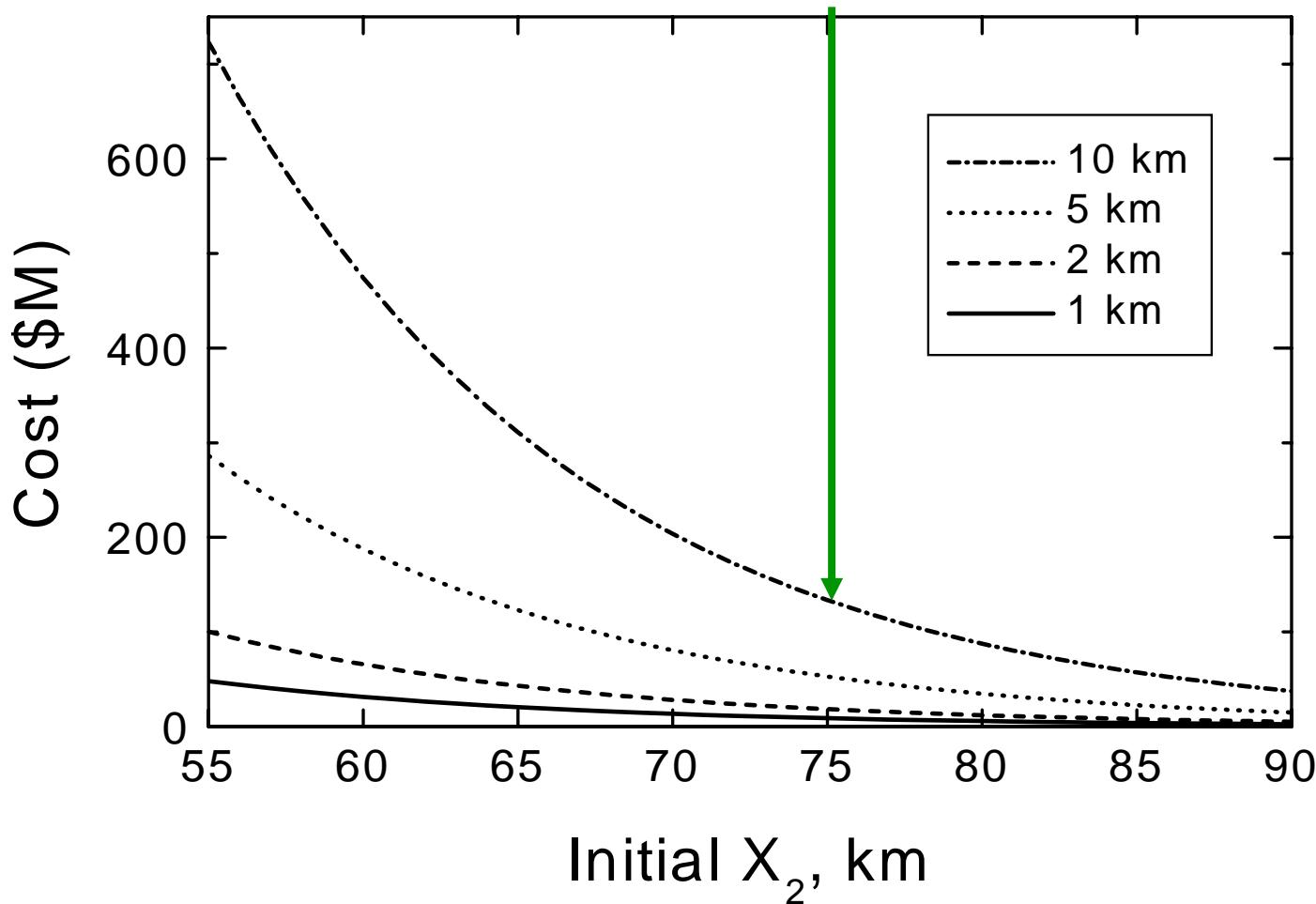
Export Flow and Inflow

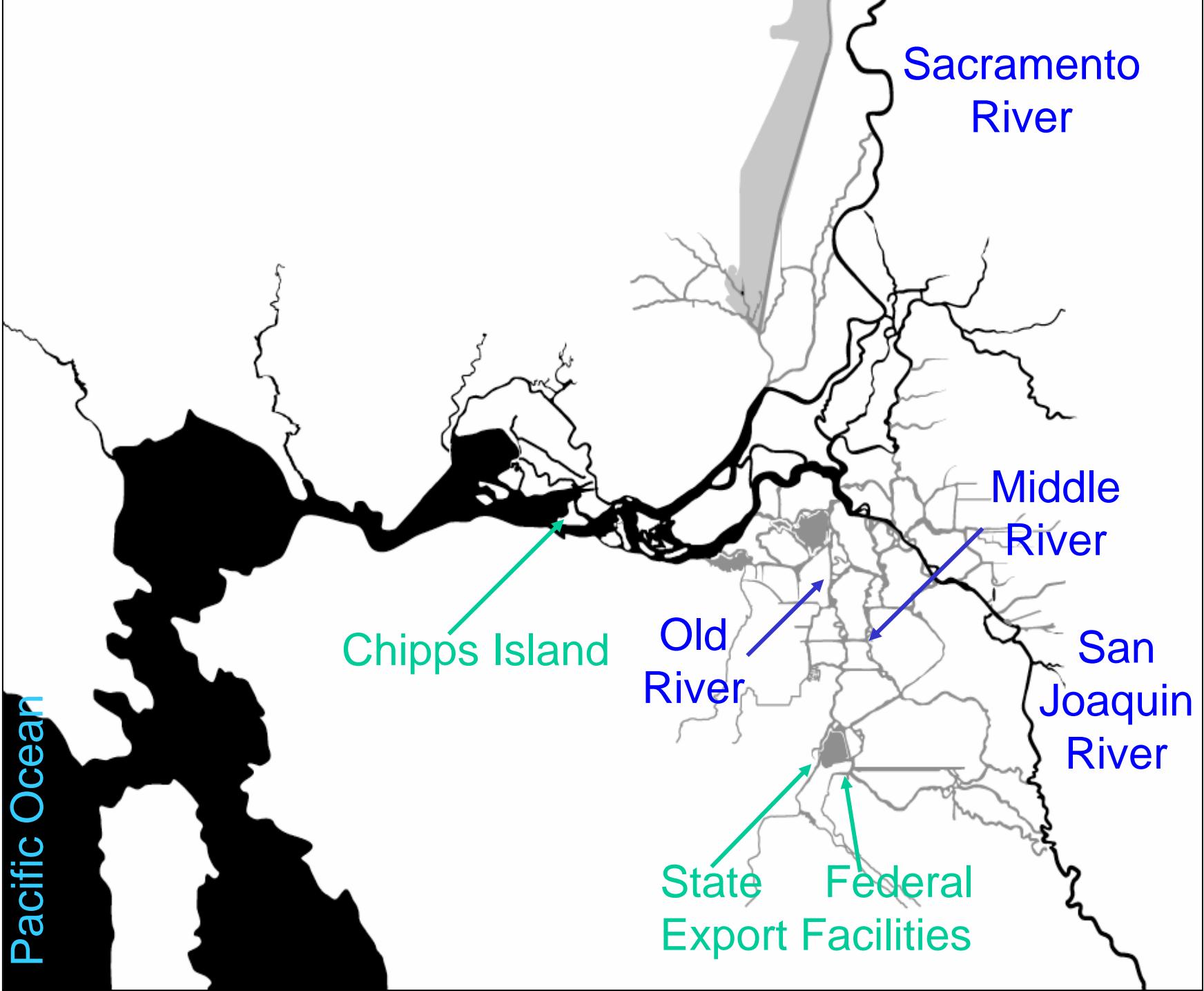
1980 – 2006, all months



A reality check on water costs

Chipp Is.





Export effects

Winter-run Chinook salmon

$$S = 1 - \frac{F_t}{A}$$

$$1 - \frac{\text{Losses to Exports}}{\text{Losses} + \text{Emigrants}}$$

Delta Smelt

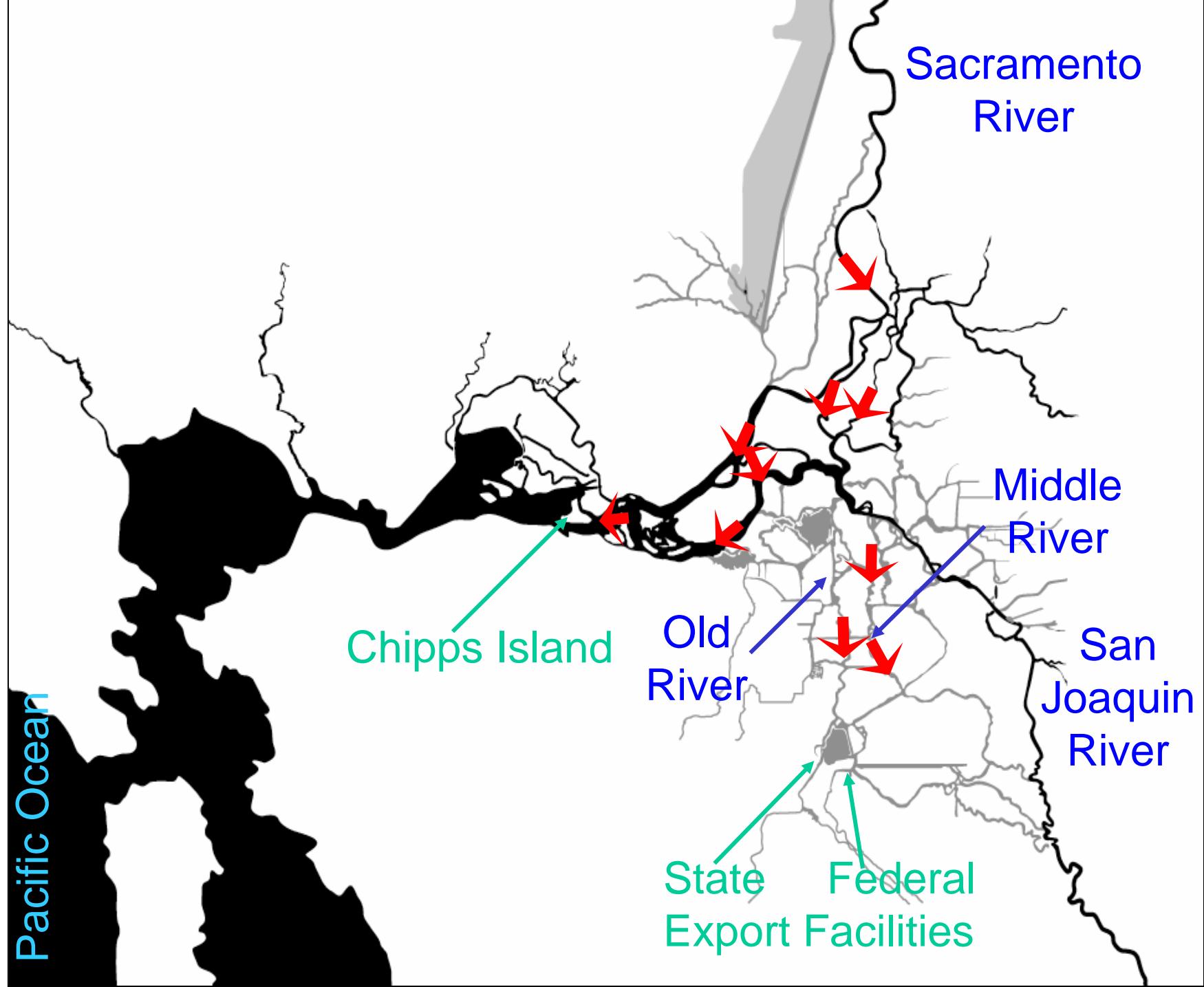
$$S = \prod \left(1 - \frac{F_d}{A} \right)$$

$$\text{Product} \left(1 - \frac{\text{Daily losses to Exports}}{\text{Population Size}} \right)$$

...with complications!

The Problem: Winter Chinook

- Fish move through the Delta
 - May become entrained
 - May die on their way
- We can't tell winter Chinook from other runs
- Behavior
 - Hatchery fish
 - Later life stage

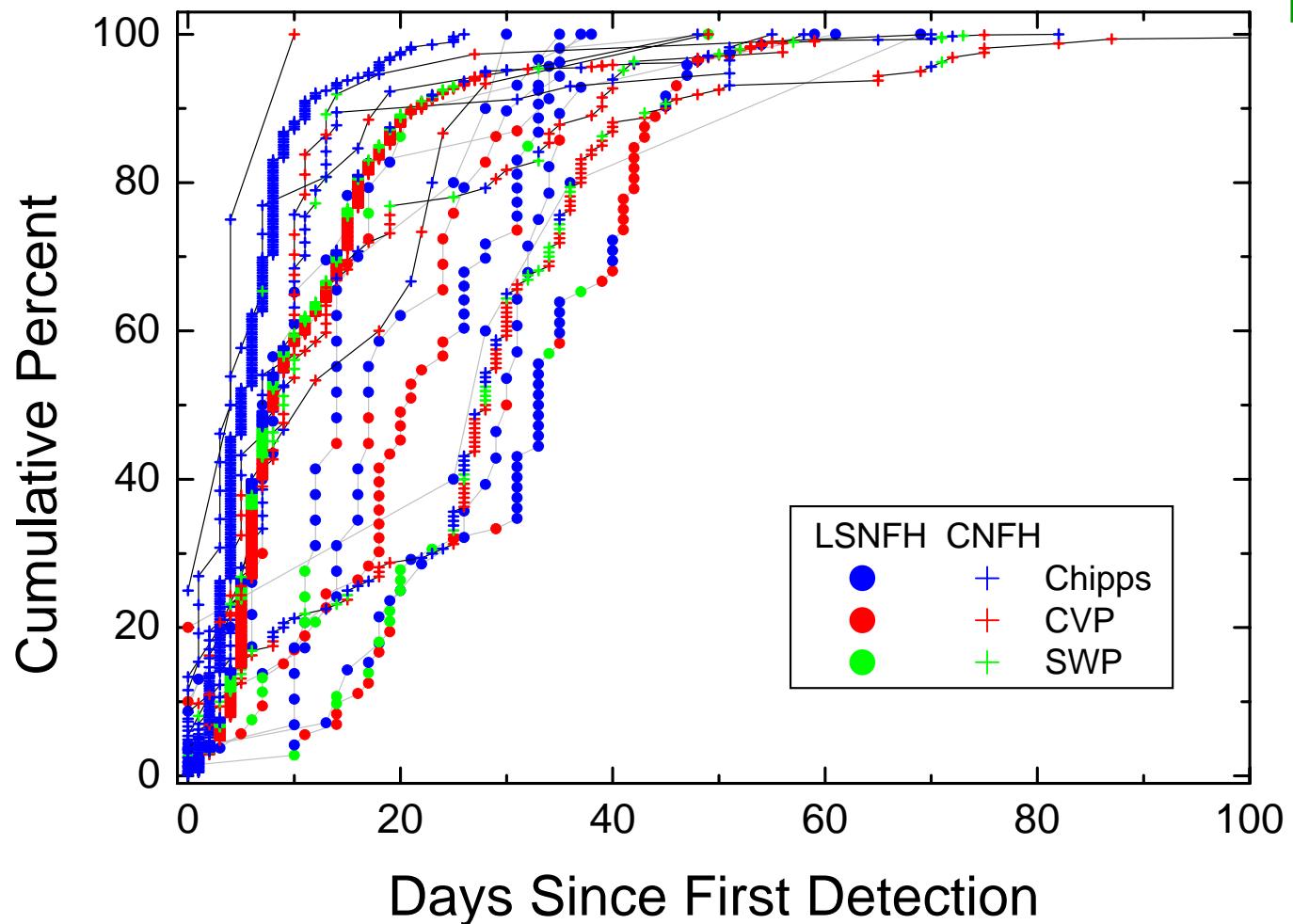


Study Design: Winter Chinook

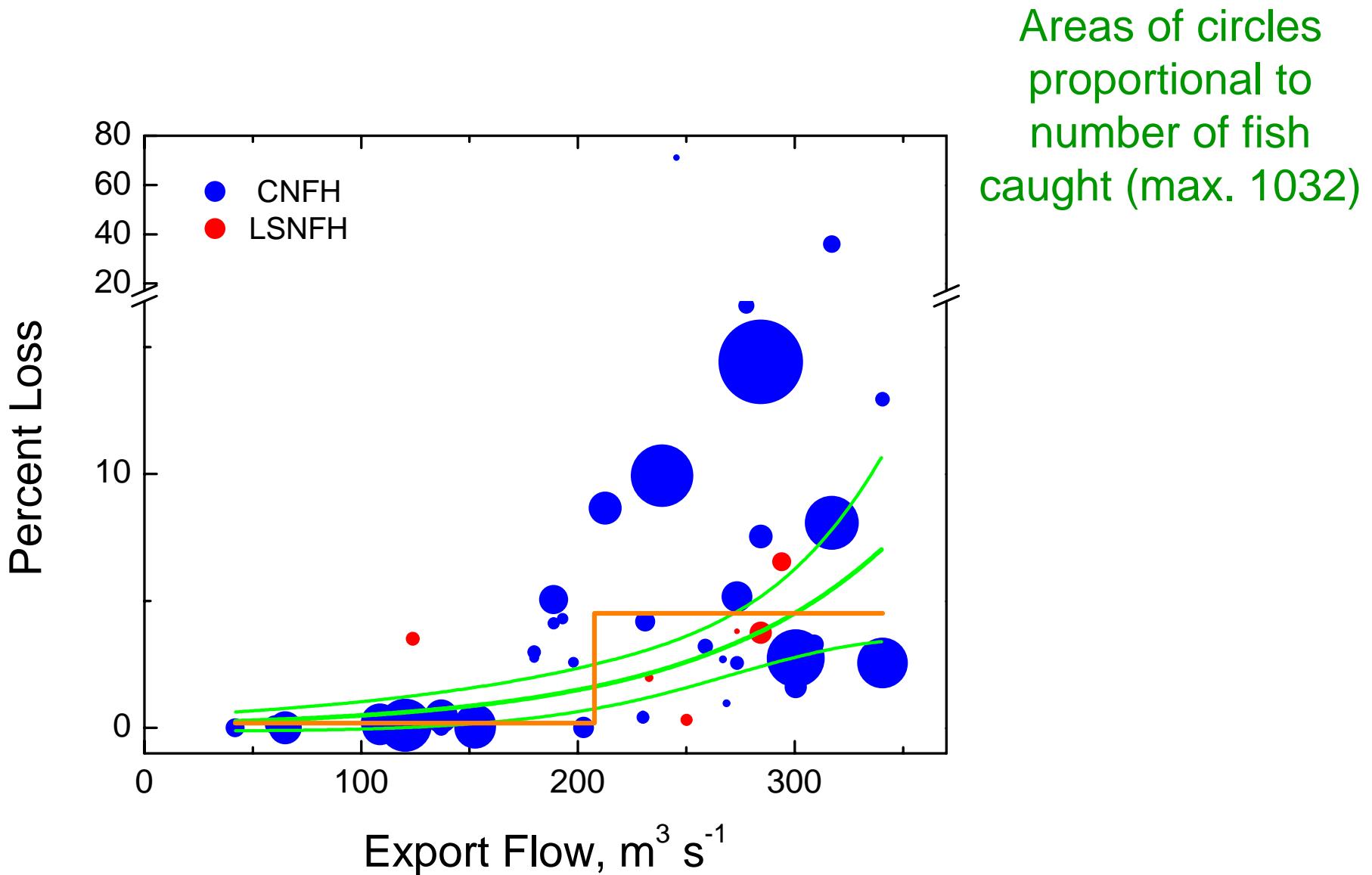
- Tagged releases from 2 hatcheries
- Loss based on salvage
 - Corrected for pre-screen mortality
- Emigrants based on Chipp's Is. Trawl
 - Calculated using estimated speed

Chinook: Cumulative catches

Examples from 2
hatcheries, 3
recapture locations



Chinook: Percent Losses

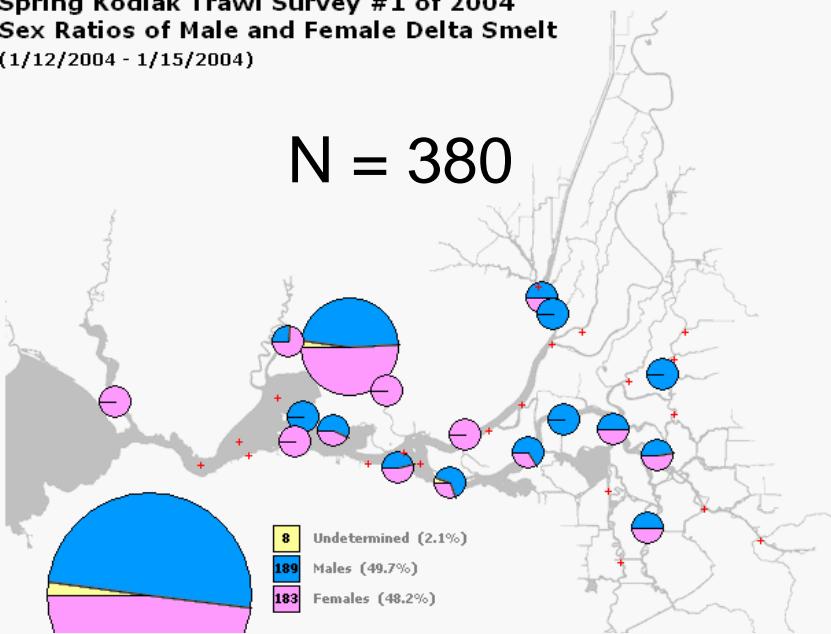


The Problem:Delta Smelt

- Adult life stage
 - Sampling issues
- Young life stages
 - Sampling issues
 - No-see-ums
 - Accumulating impact through season

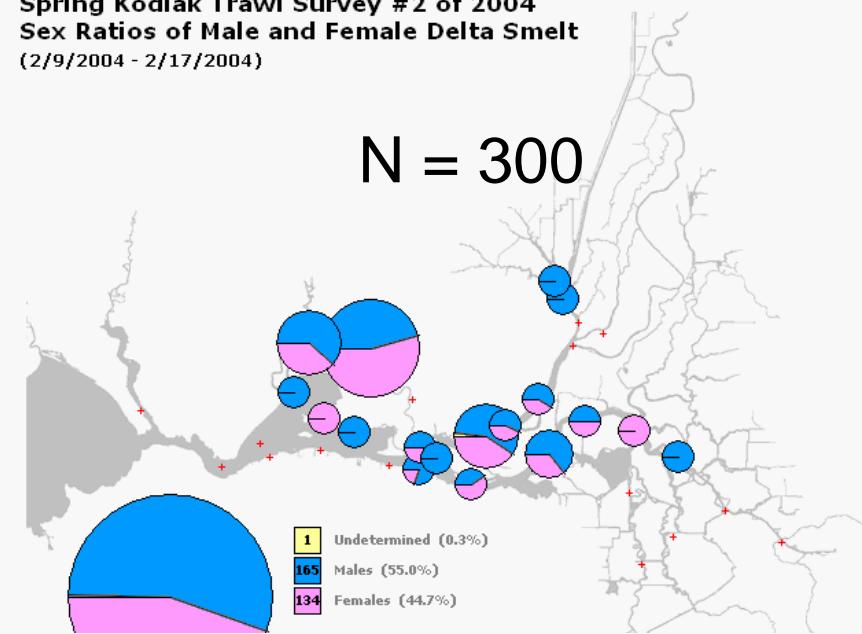
Spring Kodiak Trawl Survey #1 of 2004
Sex Ratios of Male and Female Delta Smelt
(1/12/2004 - 1/15/2004)

N = 380



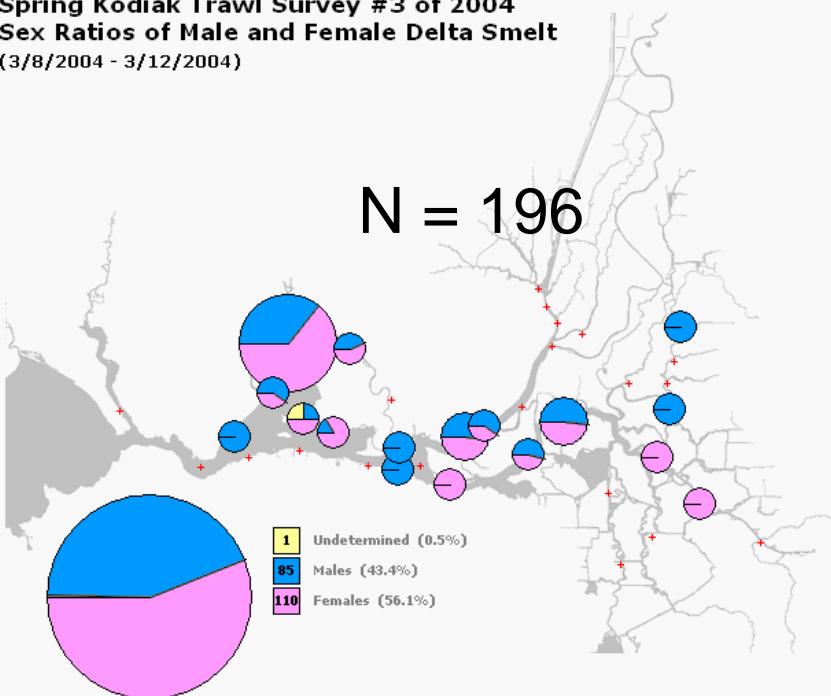
Spring Kodiak Trawl Survey #2 of 2004
Sex Ratios of Male and Female Delta Smelt
(2/9/2004 - 2/17/2004)

N = 300



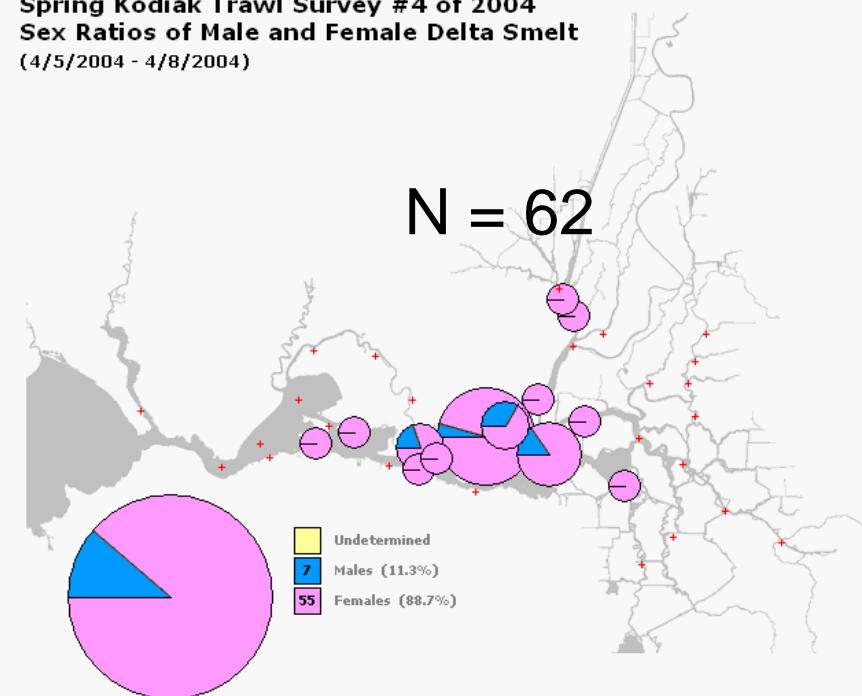
Spring Kodiak Trawl Survey #3 of 2004
Sex Ratios of Male and Female Delta Smelt
(3/8/2004 - 3/12/2004)

N = 196



Spring Kodiak Trawl Survey #4 of 2004
Sex Ratios of Male and Female Delta Smelt
(4/5/2004 - 4/8/2004)

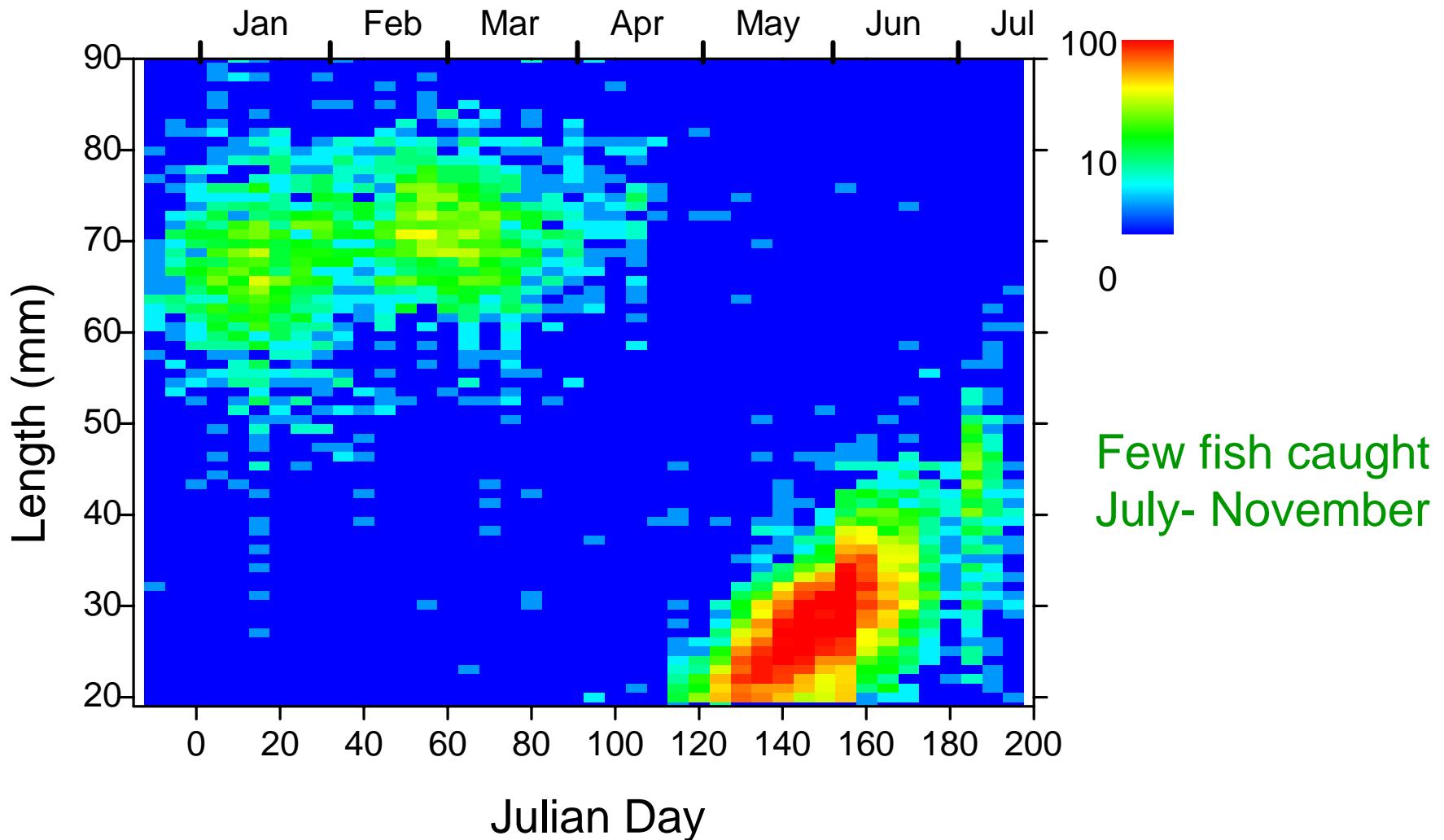
N = 62



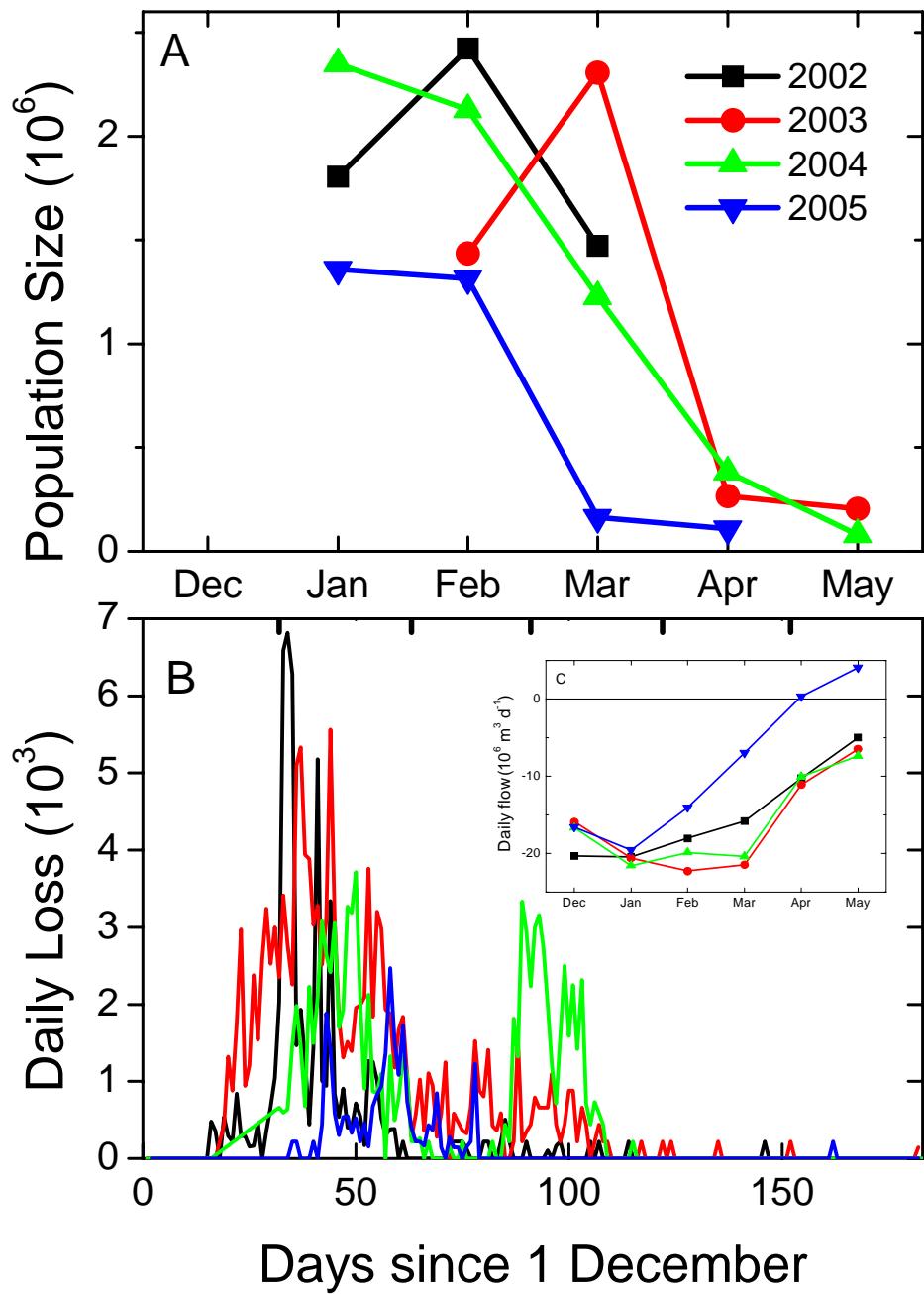
Study Design:Adult Delta Smelt

- Population based on Kodiak survey
- Loss based on salvage
 - Corrected for pre-screen mortality
 - Calibrated against catches in S. Delta
 - Old and Middle River flow (USGS)
- Survival accumulated Dec - Apr

Smelt: Length by day in salvage



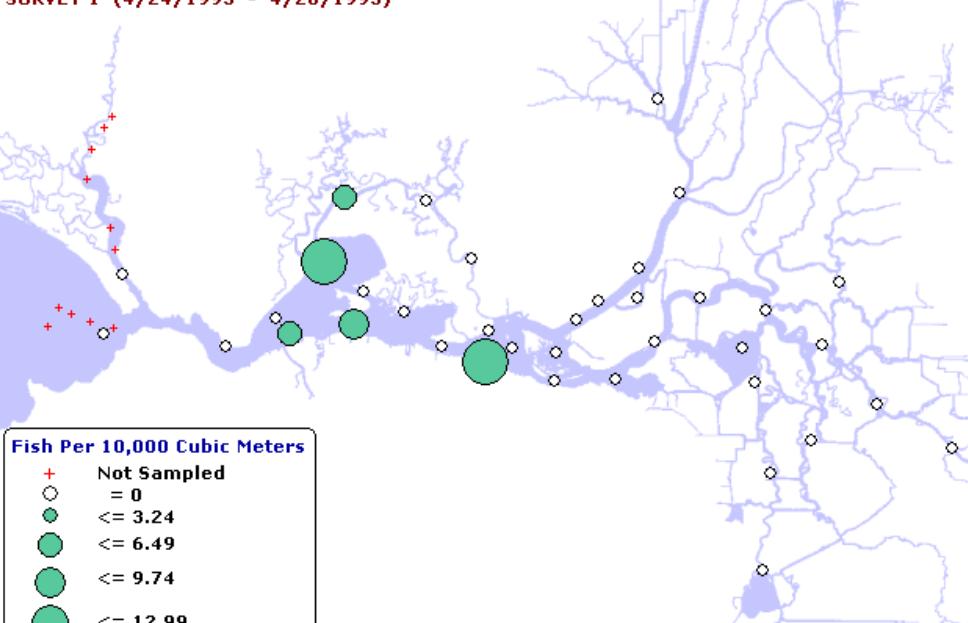
Adult Smelt: Abundance and Daily Loss



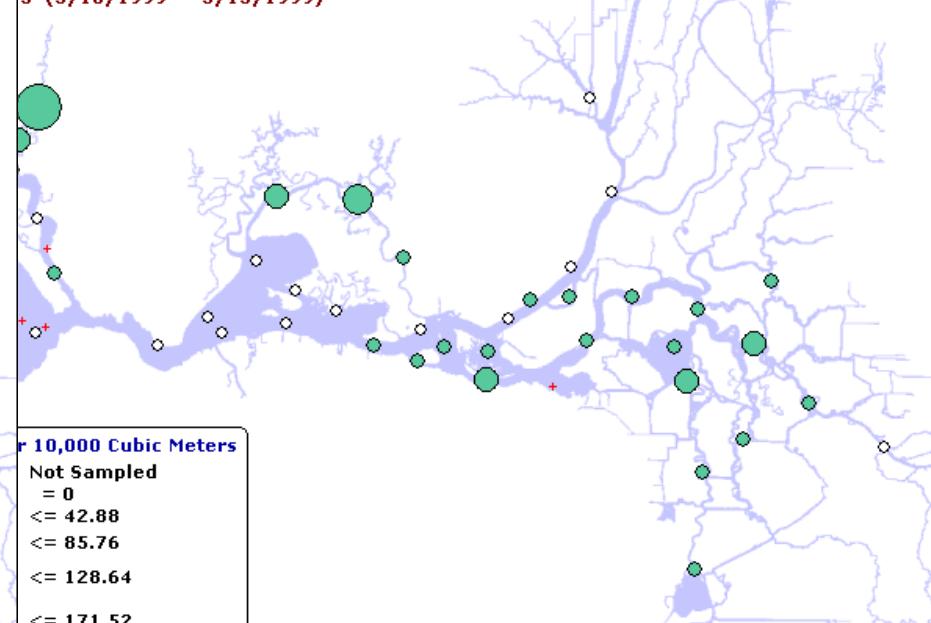
Study Design: Young Delta Smelt

- Population based on 20mm survey
- Loss based on 20mm survey
 - No need to correct or calibrate
 - Old and Middle River flow (USGS)
- Survival accumulated Mar –last survey
 - Account for hatching date
 - Account for mortality to fixed date

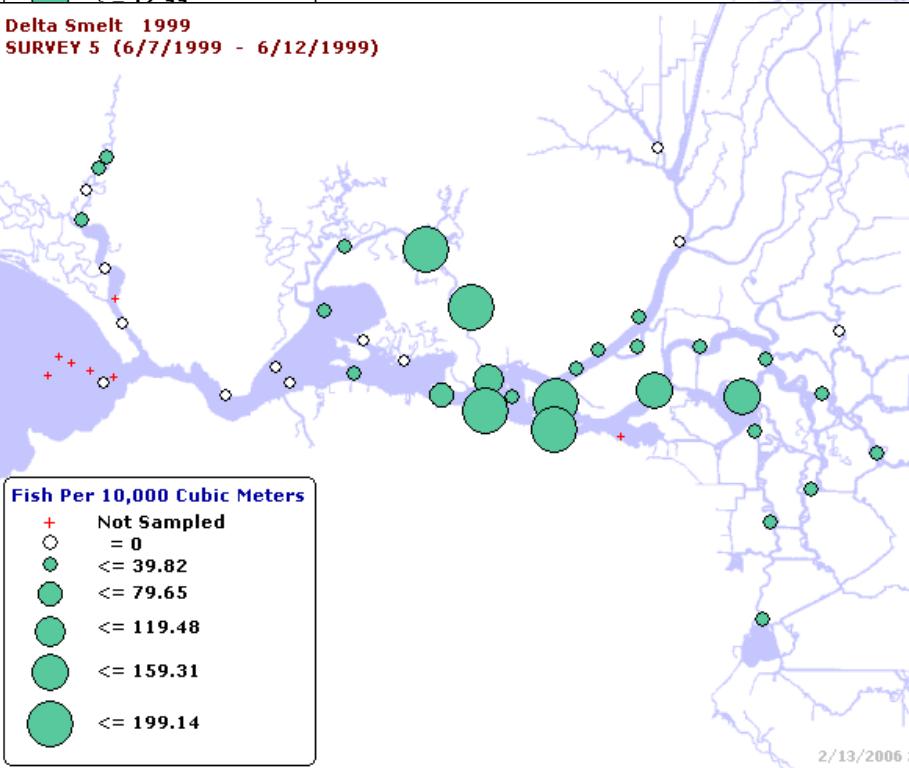
Delta Smelt 1995
SURVEY 1 (4/24/1995 - 4/28/1995)



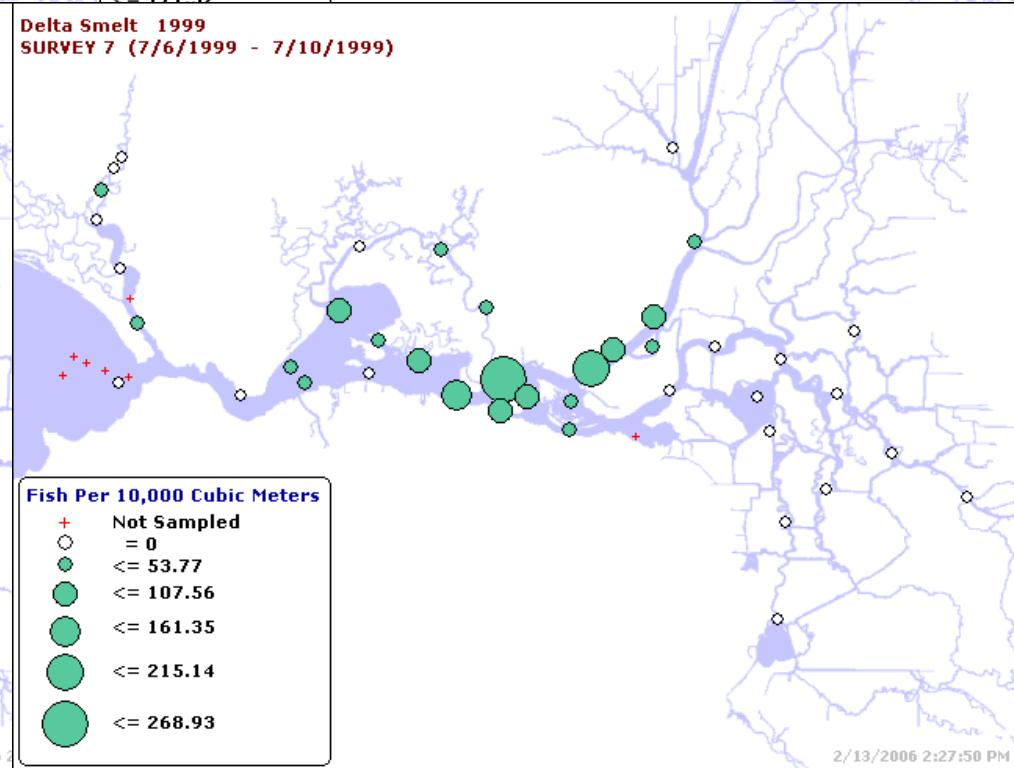
Delta Smelt 1999
SURVEY 3 (5/10/1999 - 5/15/1999)



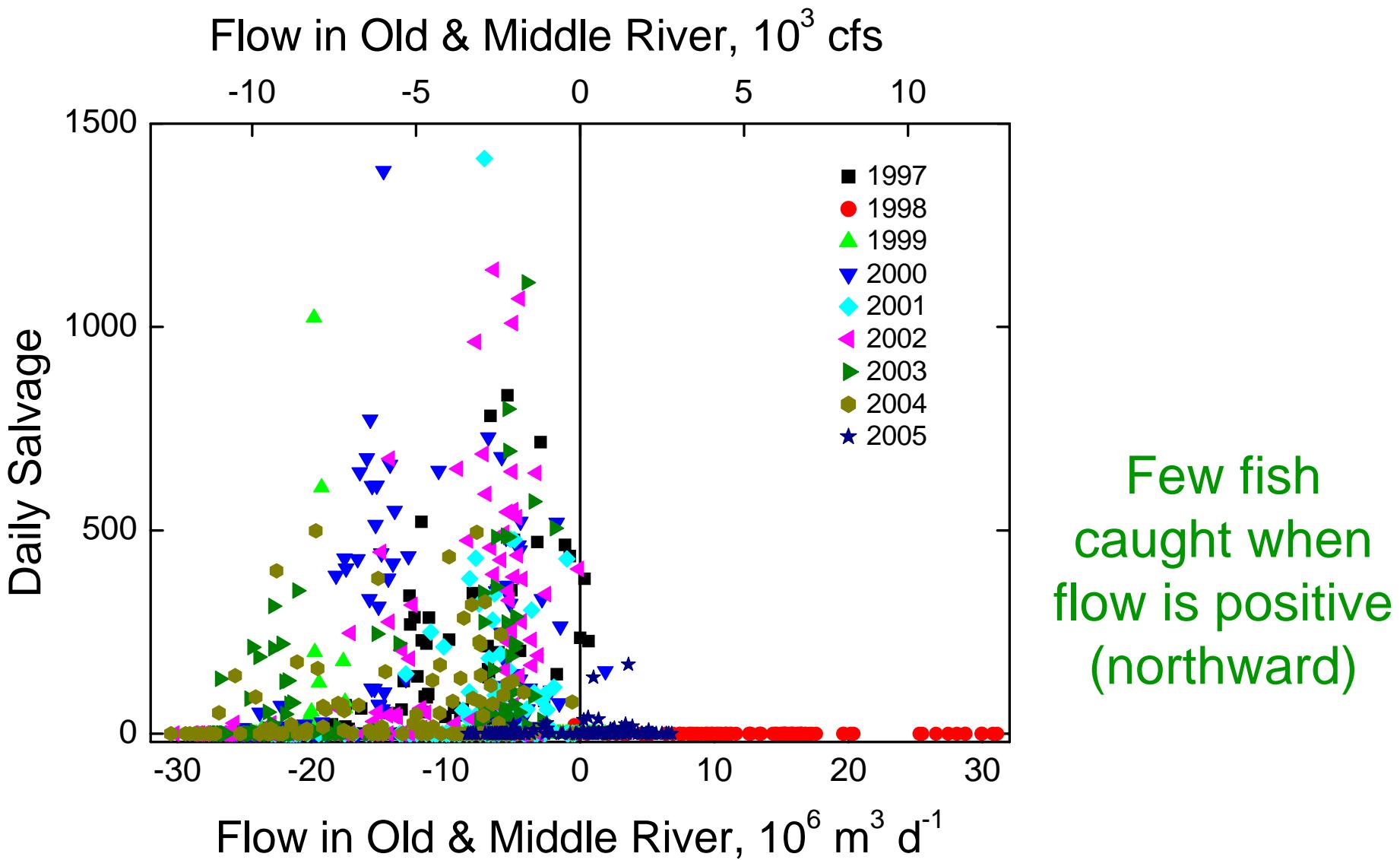
Delta Smelt 1999
SURVEY 5 (6/7/1999 - 6/12/1999)



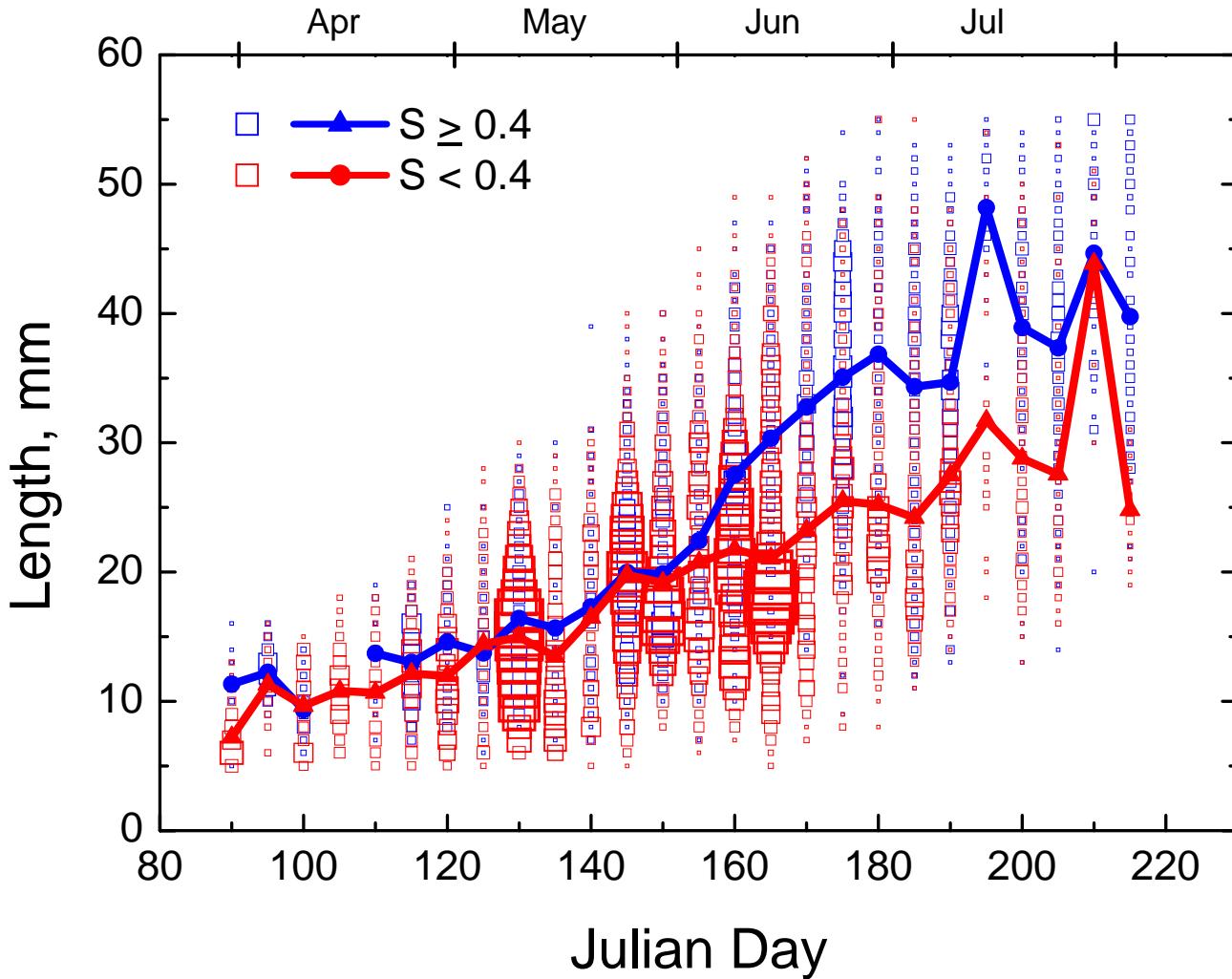
Delta Smelt 1999
SURVEY 7 (7/6/1999 - 7/10/1999)



Young Smelt: Salvage vs. Old and Middle River Flow

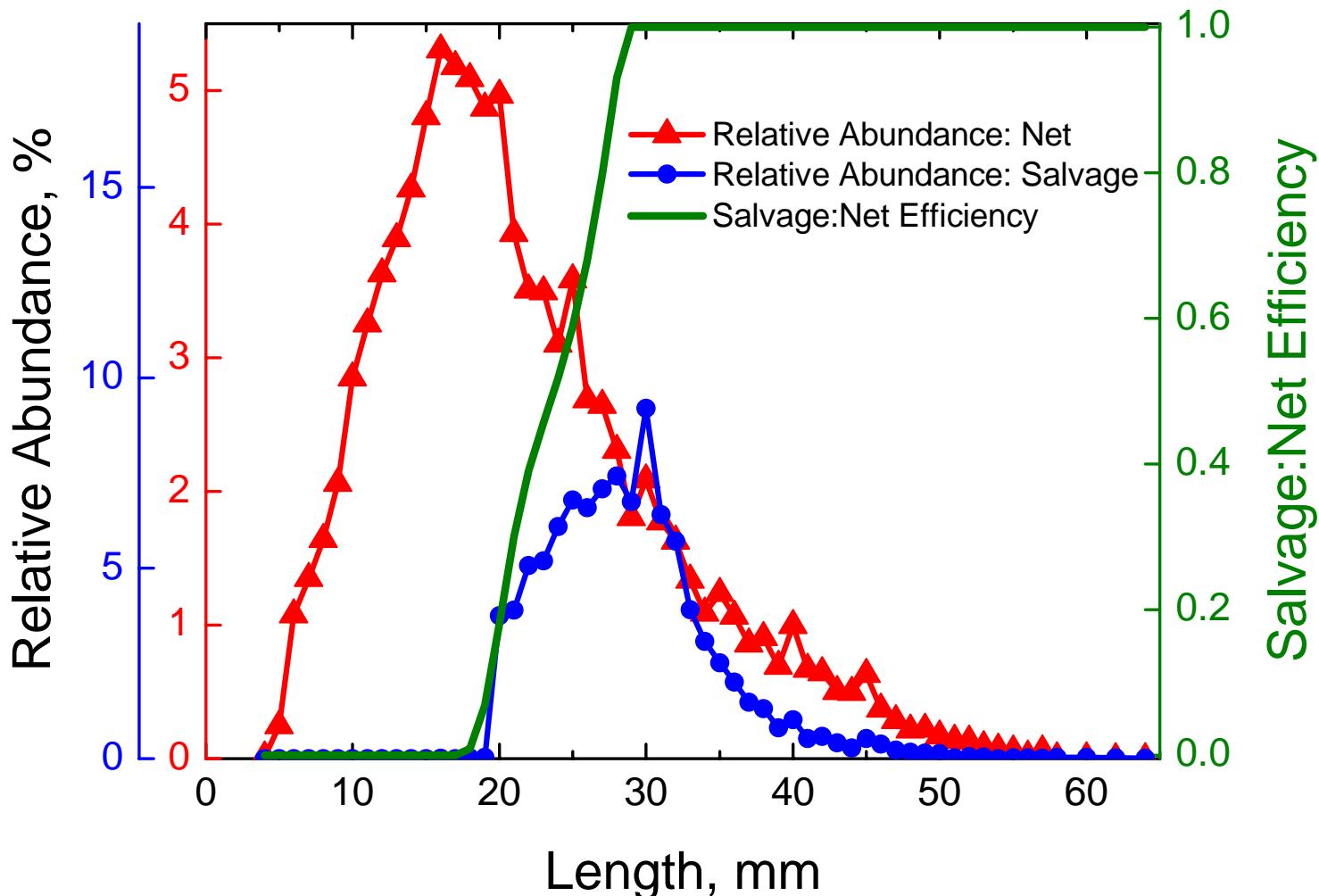


Smelt: Length by day at 2 salinities

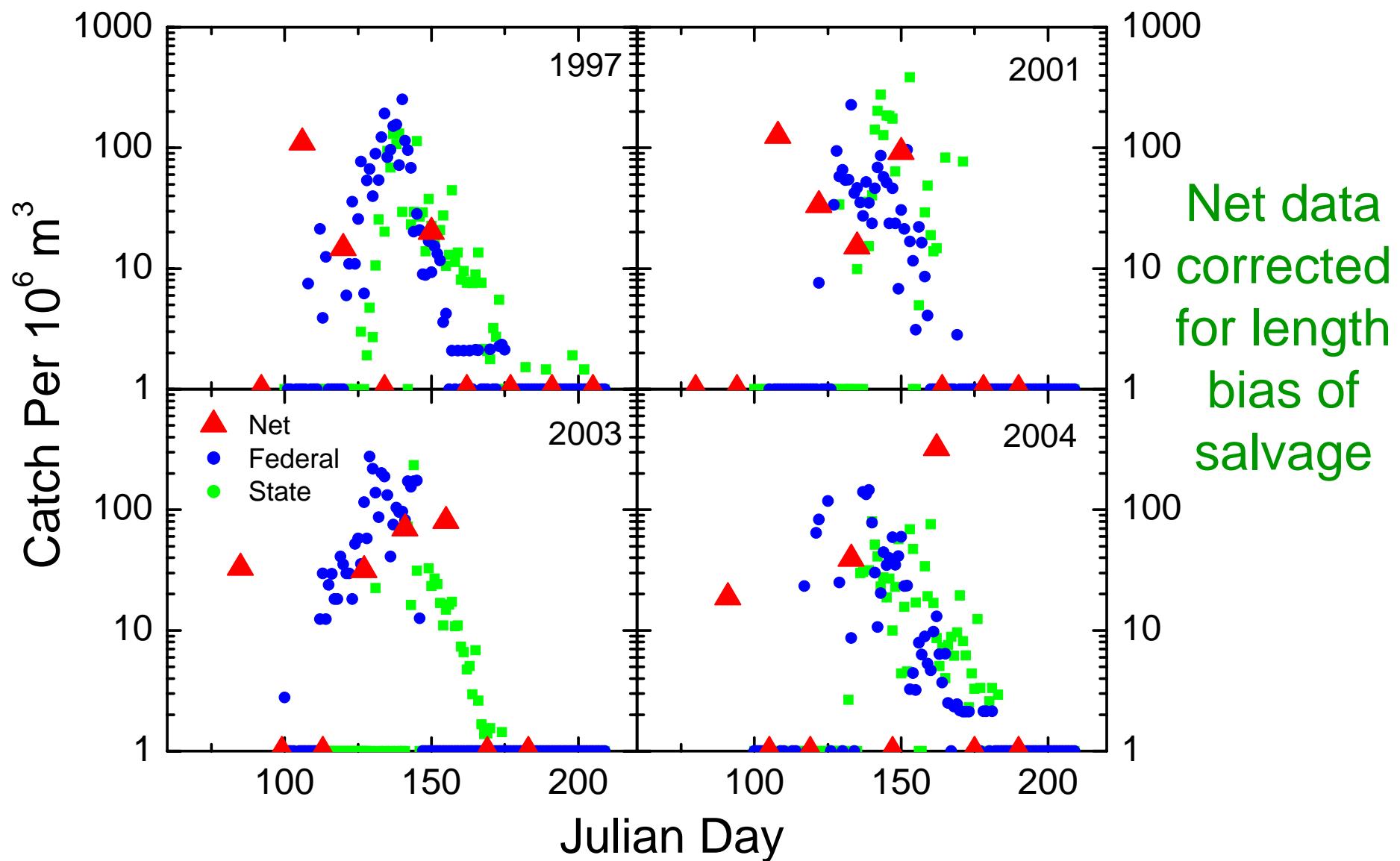


Similar until
early June

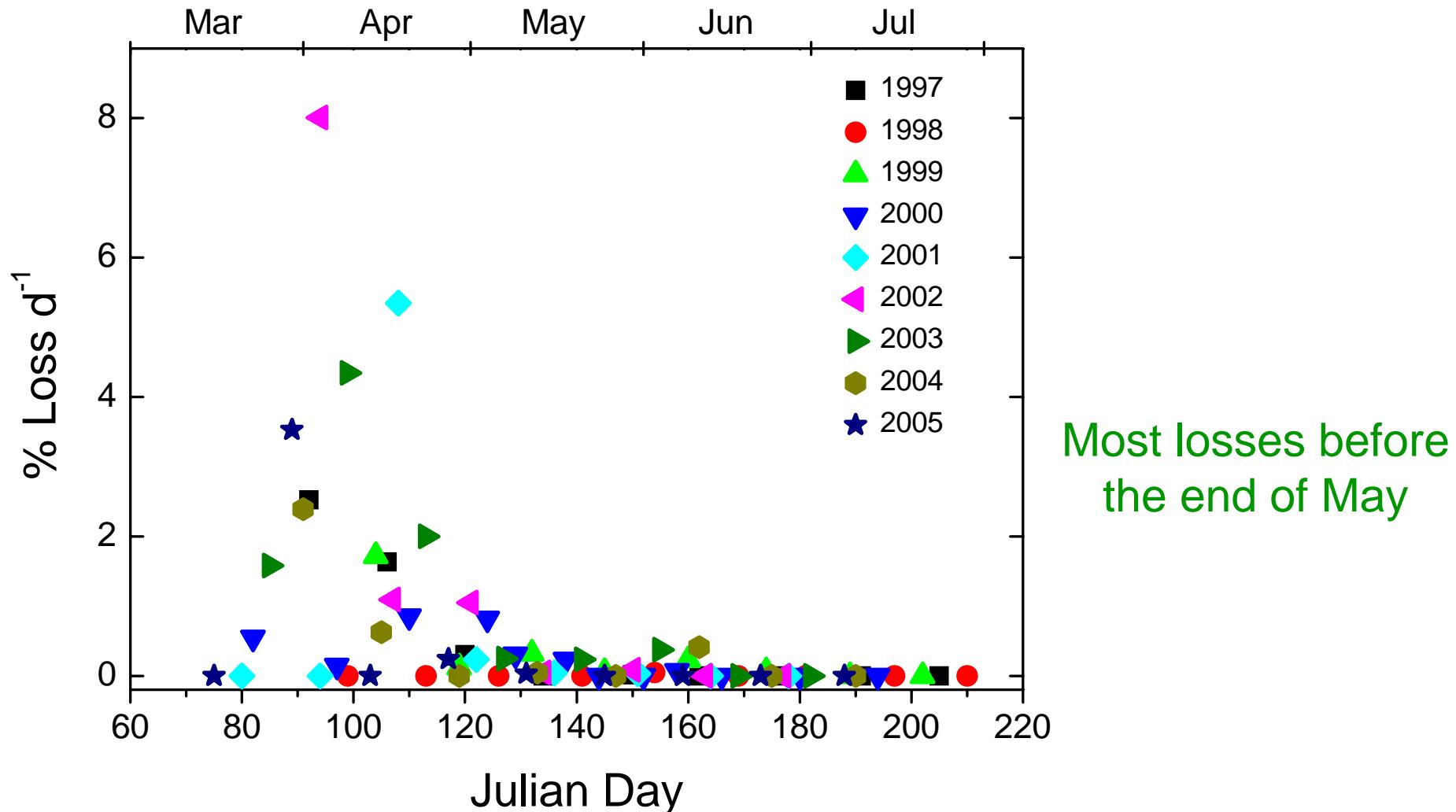
Smelt: Lengths in 20mm survey and salvage



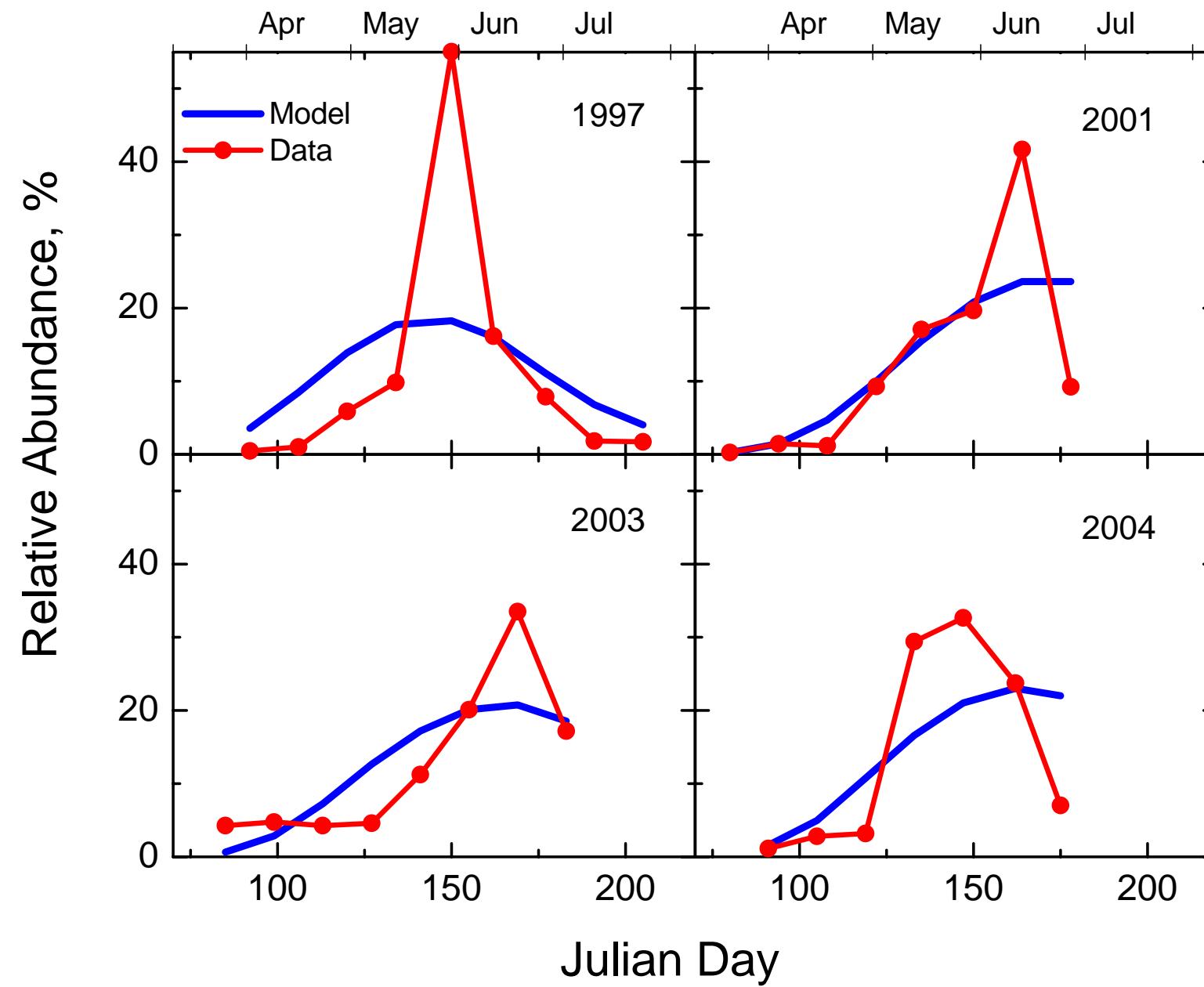
Young Smelt: Temporal distribution in survey and salvage



Young Smelt: Percent loss by survey

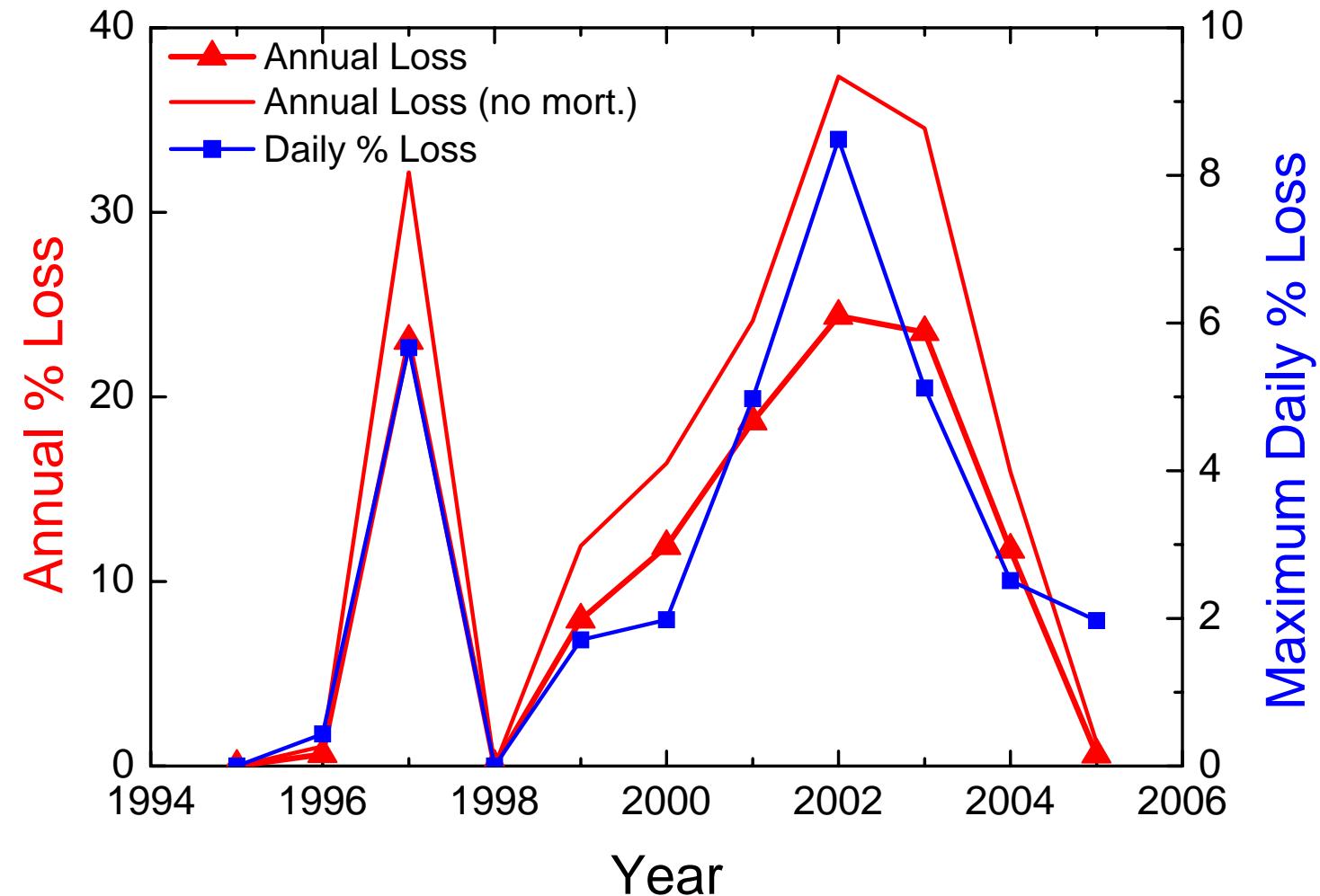


Young Smelt: Simple Models with Data

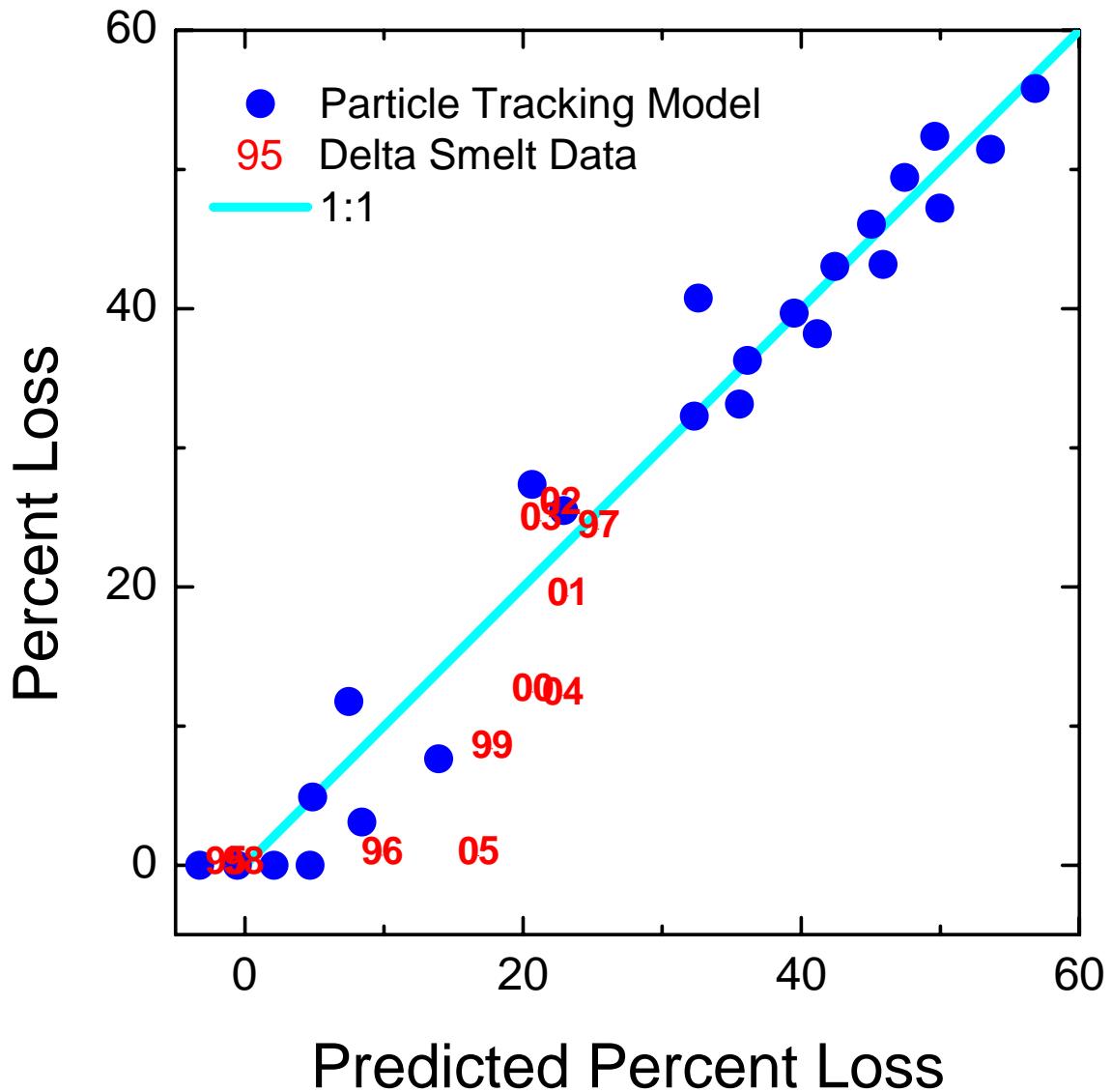


Young Smelt: Seasonal losses

Base mortality $2\% \text{ d}^{-1}$

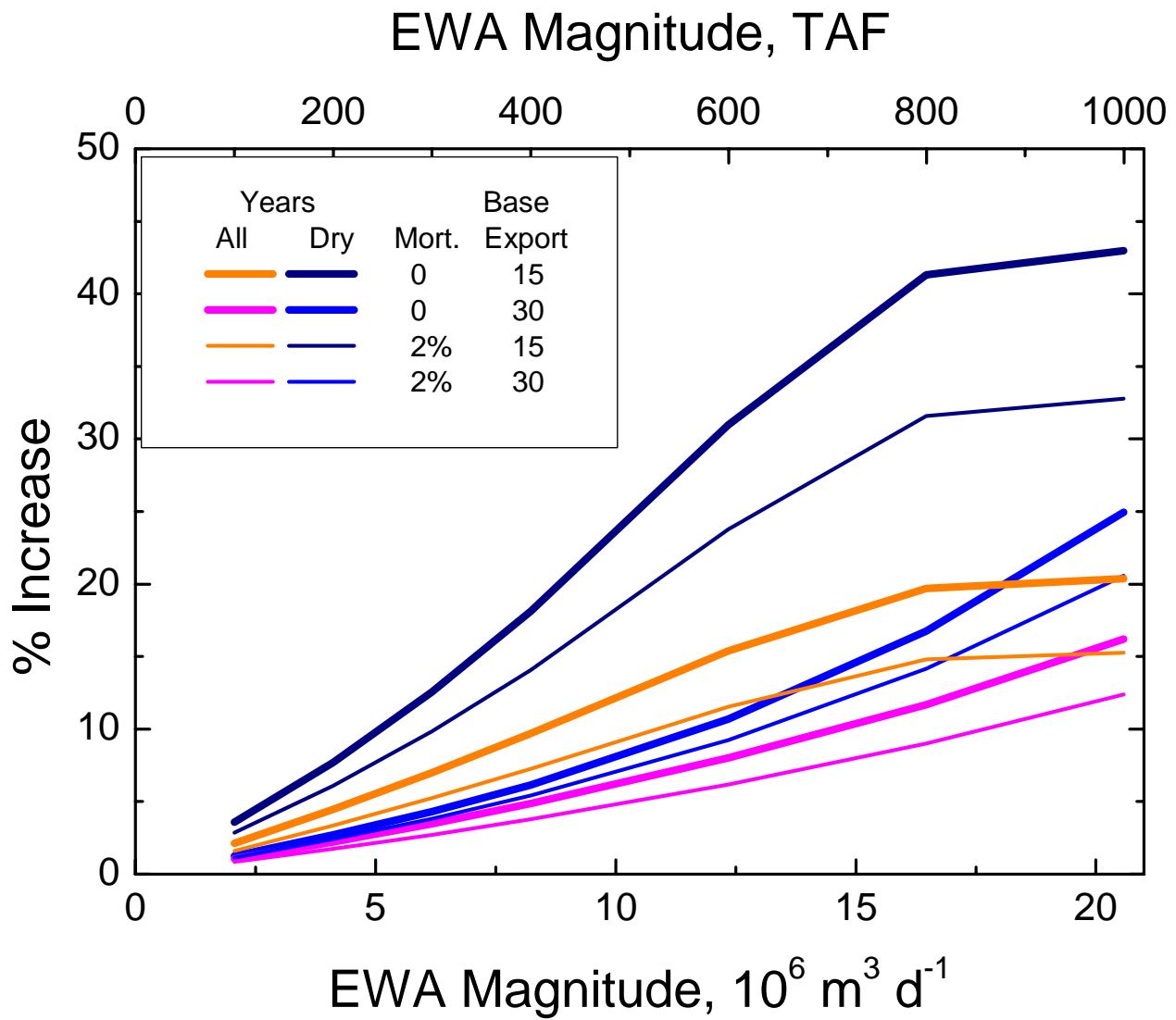


Young smelt: PTM results and seasonal losses



Particle Tracking Model:
DSM-2 model of the
Delta
Kimmerer and Nobriga
submitted, SFEWS

Young Smelt: EWA Effects



Summary of EWA Effects

	EWA Years 1-4	Optimum 300 TAF	Optimum 1000 TAF
Winter Chinook	0.5%	1%	0-10
Adult delta smelt	0.6%	2%	2-7
Young delta smelt	6%	5%	0-25